

NOTE ON THE METHOD OF COLONY FOUNDATION
OF THE PONERINE ANT BOTHROPONERA
SOROR EMERY

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The method of colony formation among the Ponerine ants presents problems of very considerable phylogenetic interest to students of the development and basic structure of formicid societies. It is of some interest that, whereas the normal method of colony foundation among higher ants is extremely easy to observe under experimental conditions, and has been reported repeatedly since the days of Réamur and Gould, it is far less easy to follow the process under controlled conditions among the Ponerinæ, where, perhaps, it would be most significant to know it. Wheeler (1) has studied the question extensively, has observed the formation of colonies by isolated females of *Odontomachus haematoda*, and has recorded a set of extremely interesting observations on the primitive Ponerines of the Australian genus *Myrmecia*. The author (2), among others, has observed the occurrence of a true nuptial flight under natural conditions in *Stigmatomma pallipes*, *Ponera coarctata*, *Odontomachus hæmatoda* and its variety *insularis*, *Ectatomma ruidum*, and *Paraponera clavata*, and has recorded observations on the method of colony formation for *Odontomachus hæmatoda* and *insularis*, *Paraponera clavata*, *Pachycondyla harpax*, *Euponera (Trachymesopus) stigma*, and *Proceratium croceum*.

The great similarity in stature between the perfect females and the worker forms of most Ponerine ants makes the supposition that young fertile females isolate themselves after the nuptial flight and rear their first brood entirely without foraging, after the manner of higher ants, very unlikely, although we have found (1938) progressive degeneration of wing musculature of fertilized females of *Stigmatomma pallipes* and *Euponera stigma*, presenting a physiological picture markedly similar to that for higher ants. To account for this situation Wheeler proposed the idea of "partial provisioning" supposing that the young

female after fertilization descends to earth and isolates herself like the queen of a higher ant, but leaves an entrance open to the cell and repeatedly forages for the developing brood. Wheeler later obtained evidence for this view in *Myrmecia* and *Amblyopone* and we have found marked indication of it with *Paraponera clavata*, *Pachycondyla harpax*, and especially with *Euponera stigma*.

It is notable, however, that in none of these observations has the complete inception of a young colony of a Ponerine ant, from the time of the isolation of the young queen to the appearance of adult workers, been recorded under artificial conditions, so that the picture of partial provisioning is lacking in completeness. It is not difficult to find half-formed young communities of Ponerine ants of many species under natural conditions, especially in the tropical rain-forests of both hemispheres, which give the most decided appearance of having been formed by isolated young females, and in the artificial nest this impression is readily confirmed. It is less easy, however, to watch the development of a young colony from an isolated female to its early adult phase under the same circumstances.

It therefore seems worthwhile to record an instance of colony foundation which was observed through its entirety under artificial conditions, and which gives the clearest evidence for partial provisioning.

Thanks to the great kindness of Dr. Victor Van Strahlen, Director of the Musée Royale d'Histoire Naturelle de Belgique and of the Parc National Albert of the Belgian Congo, it was possible to undertake myrmecological studies in this beautiful area during the summer of 1938. Fairly extensive collecting was done in the dense temperate rain forests of the Secteur Mikeno, in the Ituri Forest, and on the Ruindi Plains, and particular attention was paid to evidences of the formation of colonies by young isolated Ponerine females. The present note is concerned entirely with the species *Bothroponera soror* Emery (Ponerinæ, Ponerii).

Bothroponera soror is a fairly common, though locally distributed, active paleotropical Ponerine ant of the Congo rain forest, to which it is largely confined. It nests by preference in

the soil about decaying wet logs in the deeper forest, frequently running its galleries and chambers well into the wood, but ordinarily maintaining open communication to the earth beneath.

On July 21, 1938, two young fertile females of this species were found isolated together in a cell constructed in black lava earth on the lower slopes of Mt. Mikeno. They were transferred together to an artificial nest, to which they quickly became adapted, and fed at first with honey and later with a variety of insect food, which was readily accepted.

Eggs were laid in late August, formed into a packet and assiduously tended by both young queens. The first egg hatched on September 1, and by early November two cocoons had been spun, and there were in the colony, in addition, six larvæ and six eggs. All larvæ matured and spun cocoons normally. Throughout the period of growth of the larvæ, both adult females foraged actively, and the larvæ were kept well supplied with cut-up insect food, which they actively devoured. At no time was there any evidence of feeding of the larvæ by regurgitation. The larvæ and their resulting pupæ were of the normal size and form of those of typical workers of the species, there being none of the dwarfing so characteristic among first-brood workers of the higher ants.

When nine cocoons had accumulated, the females began systematically to destroy the older ones, cutting them open and extracting and dismembering the pupæ, which were those of already partially pigmented young workers. Seven cocoons were so destroyed, when the remaining two were artificially isolated in an attempt to save them. One of these perished, and was found to have been a normal young worker. The remaining one was returned to the colony, and was there allowed to hatch, eclosing a perfect and robust young callow of a light lemon yellow color on January 9. The young ant was treated with marked attention by the females, and freely deported, but was not injured. It immediately assumed charge of the remaining brood, and rapidly darkened in color, first to red and finally to the black typical of the species.

A second adult was eclosed on January 16, slightly smaller than the first, but otherwise like it. The females, however,

clipped off the flagella of both antennæ in the course of extracting it from the cocoon and it shortly perished.

The two females, hitherto completely cooperative, now showed slight hostility, and were separated, the entire brood being given to one. The second immediately constructed a new cell, laid additional eggs, formed them into a packet, and tended them as had the two females earlier. Two colonies were thus set up.

A third young worker was eclosed in the original colony on January 24, of unusually large size, which survived and matured normally. Workers continued thereafter to be produced in the original colony, which was now essentially established. On April 9 the first adult was eclosed in the new colony formed by the secondarily isolated female. It was large and of the form typical of the workers of mature colonies. Thereafter normal workers were regularly produced in both colonies, which took on the form characteristic of Ponerine communities in early maturity. The nests were maintained until March, 1940. During the second year the interest of the females in their respective broods diminished, although it never entirely disappeared, and they assumed the functions characteristic of older Ponerine perfect females. On December 19, 1939, a mature worker from the original colony was introduced into the offshoot group, and was immediately violently attacked. The two communities, originally fused, had thus become entirely independent, a development which is probably fairly common under natural conditions among communities originally cooperatively founded by more than one fertile female.

The colonies of *B. soror* were maintained in Lubbock earth-containing nests with open entrances housed in a greenhouse maintained at a mean temperature of 75° F. and nearly saturation humidity. Under these conditions the duration of the egg period was found to be about 15 days, of the larval instar, about 15 days, while the duration of the pupal stage was about a month. The length of larval life varied greatly with the extensiveness of larval feeding.

After death, the thorax of one of the founding queens was sectioned in paraffin. It was found that the wing musculature had practically disappeared, as it does typically among the higher ants. It would seem, therefore, that the characteristic absorption of the wing musculature after dealation which among higher ants

serves so indispensable a purpose in permitting them to form a colony without taking food during the process phylogenetically antedates that habit.

CONCLUSION

The development of these two colonies, I believe, presents a fairly clear and complete picture of the method of colony formation practiced by at least some of the Ponerine ants. Young females remove their wings following the nuptial flight, after the manner of higher ants, and, singly or in small groups, excavate cells in earth or decaying wood. Eggs are deposited, formed into a packet, and tended assiduously. The females do not isolate themselves during this time, however, but forage actively, certainly after the hatching of the first eggs, and probably before. The larvæ are fed with insect material in the fashion so typical of the Ponerines and of many higher ants. Ingluvial feeding has not been seen. The larvæ mature, and spin cocoons of normal size and form. There is no evidence of any specialized depauperate first-brood form so common among higher ants. The pupæ mature and are eclosed, aided or unaided depending upon the type, and the young workers take their place in the community. Gradually the foraging instincts of the brood-queen lapse and the egg-laying habit becomes specialized, so that the Ponerine mature queen approaches the condition of the mature female of ants of the higher subfamilies, although colonial duties are never completely relinquished during the lifetime of the former. It is to be supposed that the destruction of the earlier cocoons in the case recorded was an abnormal procedure consequent upon artificial conditions.

The whole procedure as thus observed is quite in accord with expectation, and represents a generalized condition from which we must suppose that the highly evolved methods of colony foundation of Myrmicine and Formicine ants have been derived by successive specializations.

The wing musculature of the queen is apparently destroyed during the process of colony foundation as among the higher ants, even although the young queen may freely partake of nourishment during the period. It is doubtful if any fat-body is fed to the young ingluvially, as among the higher ants, but the muscle resorption undoubtedly contributes to the resistance of the queen

herself if threatened by long periods of enforced abstinence. It would seem that this physiological characteristic phylogenetically antedated the completely claustral habit of colony formation and eventually became tributary to it.

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